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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/529,492	03/29/2005	Yasushi Enokido	268827US2PCT	9162
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OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			EXAMINER PEACE, RHONDA S	
			ART UNIT 2874	PAPER NUMBER

DATE MAILED: 03/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/529,492

Applicant(s)

ENOKIDO, YASUSHI

Examiner

Rhonda S. Peace

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 February 2006.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 4 is/are allowed.
- 6) ☒ Claim(s) 1-3, 5-7 and 12-14 is/are rejected.
- 7) ☒ Claim(s) 8-11 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 February 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file of this National Stage application from the International Bureau (PCT Rule 17.2(a)).

Drawings

The drawings were received on 2/21/2006. These drawings are in compliance with 37 CFR 1.121(d) and are suitable for publication.

Specification

The abstract of the disclosure, submitted 2/21/2006, complies with the standards set forth in the MPEP § 608.01(b), and is suitable for publication.

Claim Objections

Claims 11-14 are amended to resolve multiple dependency issues under 37 CFR 1.75(c). Accordingly, the claims 11-14 have now been further treated on the merits.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 6, 7, and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Kittaka et al (US 2002/0197042).

With regards to claims 1-3, 6, 7, and 12 Kittaka et al discloses a two-dimensional photonic crystal having a tetragonal lattice comprising a prism-shaped first dielectric area **B** arranged at each lattice point of the tetragonal lattice, a prism-shaped second dielectric area **C** arranged at the approximate center of the tetragonal lattice, and a prism-shaped third dielectric areas **A** and **D** arranged adjacent to and around the first and second dielectric areas (paragraph 0083, Figure 10). All four areas, **A**, **B**, **C**, and **D**, can be formed using different materials, including titanium oxide ($\epsilon = 40-50$), silicon ($\epsilon = 11-12$), tantalum oxide ($\epsilon = 11.6$), niobium oxide, and air, all having different dielectric constants, the values of which are well known (paragraphs 0083, 0129, and 0146-0151). For example, the disclosure of Kittaka et al supports a structure (as the main requirement for the materials used is that they secure transparency in an operating wavelength range) where **B** is chosen to be formed of silicon, having a well known dielectric constant of 11-12, and **C** is chosen to be formed of titanium oxide, having a well known dielectric constant of 40-50, thereby creating a structure where ϵ_1 , the dielectric constant of the first area **B**, is less than ϵ_2 , the dielectric constant of the second area **C** (paragraphs 0129-0130). Moreover, the disclosure of Kittaka et al supports a structure where **D** is chosen to be formed of titanium oxide, having a well known dielectric constant of 40-50, and **B** is chosen to be formed of air, thereby creating a structure where ϵ_3 , the dielectric constant of the third area **D**, is greater than ϵ_1 , the dielectric constant of the first area **B** (paragraphs 0129 and 0146-0151). In addition, the structure is designed to give desired results and the source light frequency must

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inherently be considered when designing dimensions for a diffractive element, such as the device of Kittaka et al, in order to ensure proper diffraction within the device.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kittaka et al (US 2002/0197042) in further view of Cotteverte et al (US 6542682).

Pertaining to claim 5, Kittaka et al disclose the two-dimensional photonic crystal as described above, including the use of air as materials A and B, the third and first dielectric areas (paragraphs 0129 and 0149-0151). However, Kittaka et al does not disclose an arrangement where the first and second areas (B & C) are arranged to have the same relative dielectric constants. Cotteverte (US 6542682) discloses a three

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dimensional photonic crystal having a tetragonal lattice, where each of the first and second dielectric areas, those arranged at the lattice points, or in the center of the corresponding lattice, are filled with air (Figure 1, column 1 lines 34-44). This is a common method by which to form photonic crystals, using cylindrical vias filled with air to act as dielectric areas, and is well known in the art, in teachings other than Cotteverte et al. It would have been obvious to one of ordinary skill in the art to combine the teachings of Cotteverte et al and Kittaka et al to form a photonic crystal where the first and second areas are filled with air, so as to have equal relative dielectric constants, as this is a procedure well known in the art, and allows the user to further specialize the device of Kittaka et al to their particular application.

Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kittaka et al (US 2002/0197042) in further view of Noda et al (US 2005/0147371).

With regards to claims 13 and 14, Kittaka et al discloses the device as described above. However, Kittaka et al does not disclose introducing either a linear defect or a point defect in the periodical lattice arrangement of the two dimensional photonic crystal. Noda et al discloses a two dimensional photonic crystal where a linear defect and a point defect are introduced into the photonic crystal structure (Noda, paragraph 0006). It would have been obvious to one of ordinary skill in the art to combine the teachings of Noda et al to the teachings of Kittaka et al, as the introduction of a linear defect allows the photonic crystal to function as a waveguide (Noda, paragraph 0006) and the introduction of the point defect allows the photonic crystal to function as a resonator (Noda, paragraph 0006). Both modifications allow the photonic crystal to be

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used in a wide variety of applications not previously available with the device as described by Kittaka et al.

Allowable Subject Matter

Claims 8-11 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: With regards to claim 8, the applicable prior art does not disclose, nor does it reasonably suggest, a two-dimensional photonic crystal where a first, second, and third dielectric areas, having dielectric constants ϵ_1 , ϵ_2 , and ϵ_3 , respectively, satisfy the following relationships:

$$(\epsilon_3 > \epsilon_1), \text{ and } (\epsilon_2/\epsilon_1 > 20).$$

Moreover, and pertaining to claims 9-11, the prior art does not disclose the use of ceramic as a dielectric material in a two-dimensional photonic having the structure necessitated by the limitations of the independent claim.

Claim 4 is allowed.

The following is an examiner's statement of reasons for allowance: The applicable prior art does not disclose, nor does it reasonably suggest, a two-dimensional photonic crystal where a first and second substantially cylindrical dielectric areas (whose limitations such as placements are discussed within claim 1) satisfy the following relationship as is required in claim 4:

$$0.4a \leq r_1 + r_2 \leq 0.6a$$

where a represents a unit length of the lattice axis, r_1 indicated the radius of the first dielectric area, and r_2 represents the radius of the second dielectric area..

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Response to Arguments

Applicant's arguments filed 2/21/2006 have been fully considered but they are not persuasive. Applicant argues that Kittaka et al does not disclose the claimed subject matter of Applicant's claim 1, as "Kittaka et al does not disclose or suggest that the first dielectric area and the second dielectric are 'prism-shaped.'" However, the accepted definition for a prism is as follows: a solid figure whose bases or ends have the same size and shape and are parallel to one another, and each of whose sides is a parallelogram. A parallelogram is defined as four-sided plane figure with parallel opposing sides. Kittaka et al defines each of the regions A-D to be "quadratic cylinders" which have an end face in the x-y plane and extend in the z-direction (0083, Fig 10). It is clear from Figure 10 (in light of the above definition), as well as the description provided by Kittaka et al, that the first dielectric area and the second dielectric are prism-shaped.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hoshi et al (US 2006/0029349) discloses a three-dimensional Photonic Crystal and optical element. Miller et al (US 6591035) discloses a method for dispersing light using multi-layered structures.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rhonda S. Peace whose telephone number is (571) 272-8580. The examiner can normally be reached on M-F (8-5).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on (571) 272- 2344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Rhonda S. Peace
Examiner
Art Unit 2874


MICHELLE CONNELLY-CUSHWA
PRIMARY EXAMINER
3/13/06